

# AC Overloading

VER 01, UPDATED ON SEP 01, 2020

Recently, many Chinese inverter manufacturers have been promoting the concept of AC overloading. They may often claim that the capacity of an inverter is 100kW and that it is capable of 10% AC overloading in China but then market the same product as a 110KW inverter with no AC overloading to their international audience.

So is this a 110KW inverter or 100kW inverter?

What benefits can AC overloading bring to owners?

This article will discuss the above issues.

## 1. Why are Chinese inverter manufacturers emphasizing the concept of AC overloading?

- 1) In early Top Runner projects, the DC / AC ratio was 1:1. But in some regions of China, radiation is very good, and actual generated power is greater than rated power. This leads to PV power limitation. Therefore, the Top Runner project now requires the inverter to have an overloading capacity of 2~4 hours to avoid PV power limitation and improve system efficiency.

The Top Runner is a project led by the National Energy Administration of China. Most of the projects adopt the latest technology and products and put forward high technical requirements for the product. In order to meet the requirements of the Top Runner project, inverter manufacturers have added AC overloading capacity.

- 2) When designing projects in China, the AC side overloading is not only reflected in the inverter, but also in the transformer and AC protection equipment, so as to ensure that under good radiation conditions, there will be no limitation on PV generation.

At present, most inverters can support 8 hours continuous AC overloading and the actual AC output of an inverter can reach 1.1 times rated capacity.

## 2. When selecting inverters according to power for project design, should AC overloading be included in the calculation?

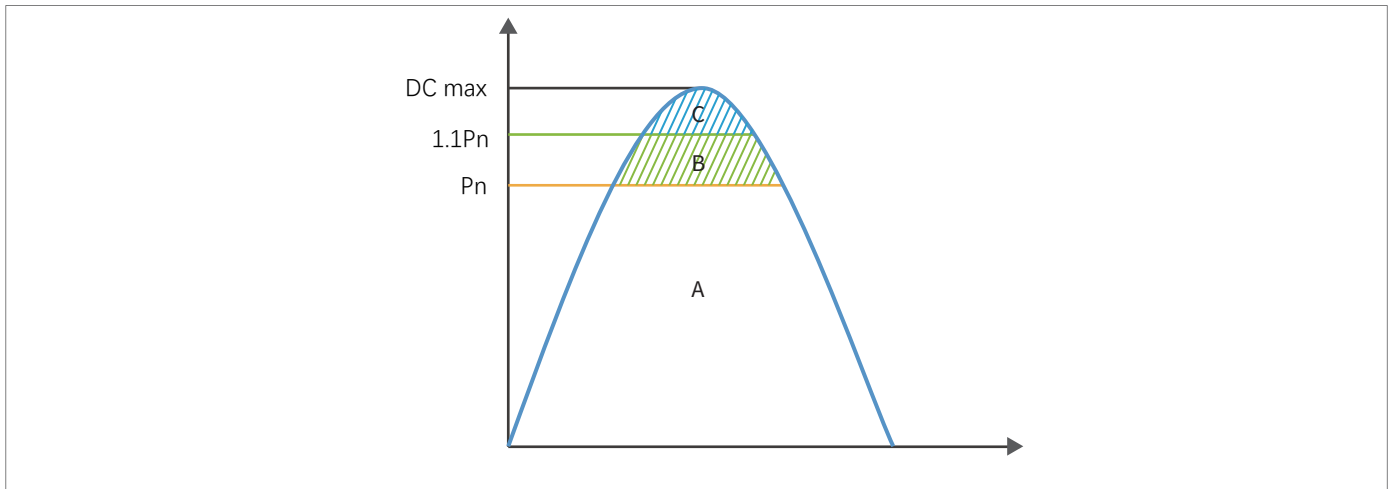
This is not recommended because most inverters only support continuous AC overloading capacity for 4~8h. If the inverter has been working under AC overloading conditions for over 8h, the service life of the machine will be affected. One advantage of GoodWe inverters, compared to other brands, is that they can support long-term overloading. Moreover, inverters are certified according to rated power.

# AC Overloading

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## 3. What are the benefits of AC overloading?

- 1) At present, increasing the DC/AC ratio is often used to reduce the cost of LCOE. Moreover, the utilization rate of bifacial modules in projects is gradually improving and DC capacity is often greater than AC capacity, as shown in the following figure:



In the design of PV power stations, the DC/AC ratio is often set between 1.0 ~1.5.

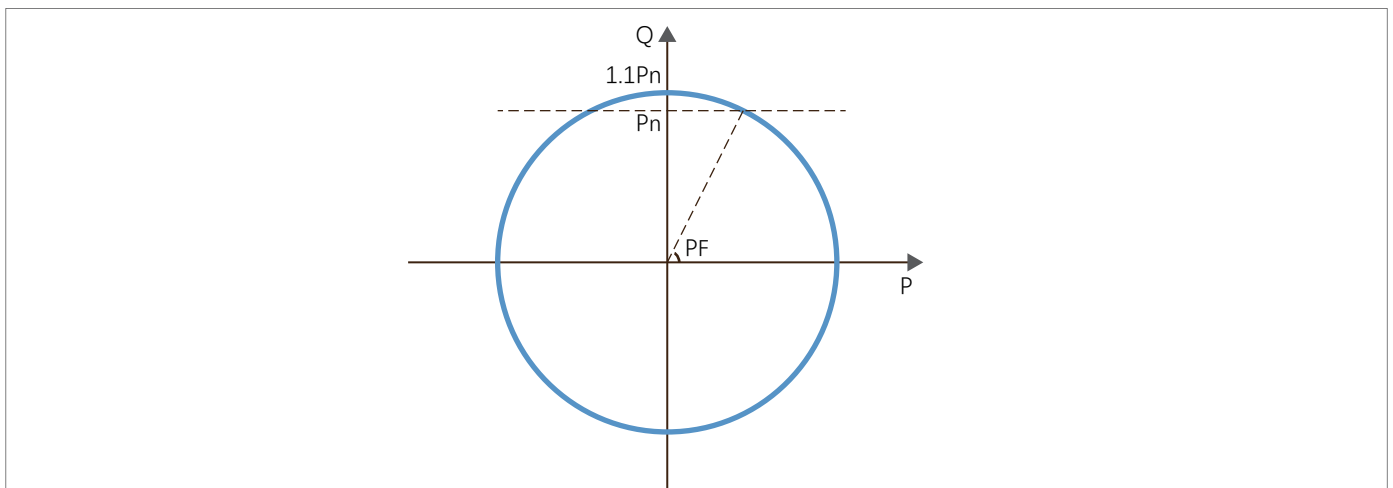
DCmax means the maximum power of DC side, including DC oversize configuration. Pn is the rated output power of the inverter, 1.1Pn is the power that can be attained with AC overloading.

If the inverter does not support AC overloading, the actual power generation is area A.

If the inverter does support AC overloading, then actual power generation is area A+B.

Area C is the rejection part due to limited PV generation. Area B is the additional generated capacity offered by AC overloading.

- 2) In addition, in some sites, the government dispatches PV power stations, which need to generate some reactive power. If the inverter supports AC overloading, the adjustable range increases from Pn to 1.1Pn, as shown in the following figure:



# AC Overloading

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More active power can be generated while the reactive power is guaranteed because the adjustable range is wider. For example, when a 50KW inverter works at PF=0.9, the active power is as shown below

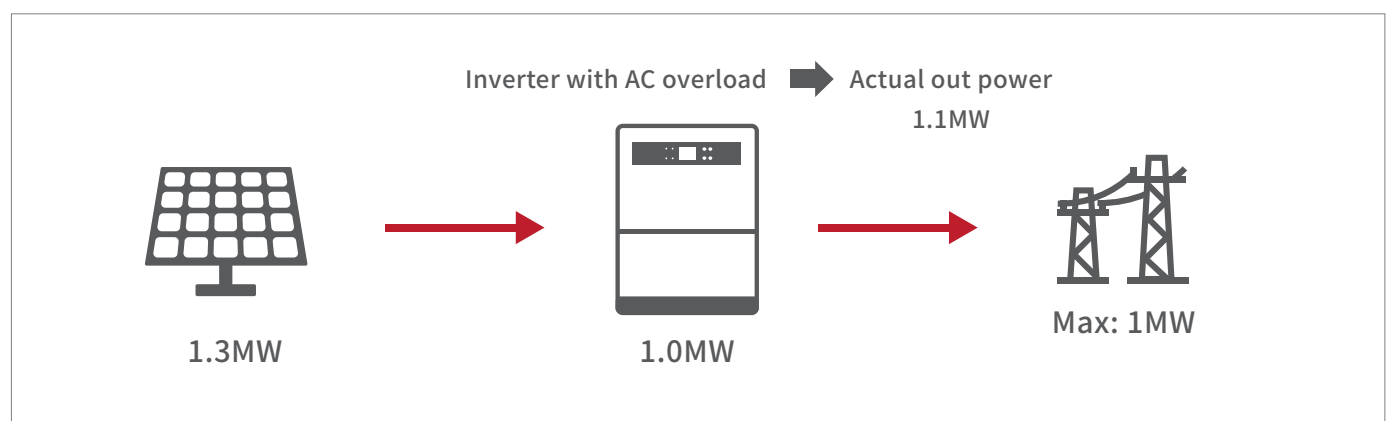
50kw INVERTER	S (Apparent power)	P (Active power)
Supports AC overload	55kw	49.5kw
Does not support AC overload	50kw	45kw

In this case, 4.5kw of additional active power can be generated.

## 4. Points to consider in the design of AC overloading

### 1: Power limit solution

Nowadays, many power stations require Power Limit function. For example, the power of a PV station may be limited to 1MW. However, in the case of inverters with AC overloading capacity, the actual output power will be greater than 1MW, up to 1.1MW, as shown in the figure below:



In this case, we need to turn off the AC overloading capability, or use the power limit solution to limit the power to less than 1MW.

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## 2: Calculation method of AC overloading capacity

AC overloading capacity partly depends on grid voltage. Refer to the following table:

AC Output Data				
Nominal Output Power (W)	60000	60000	60000	70000
Max. Output Power (W)	66000@400Vac	66000@400Vac	66000@400Vac	77000
	69000@415Vac	69000@415Vac	69000@415Vac	/
Max. Output Apparent Power (VA)	69000@415Vac	69000@415Vac	69000@415Vac	77000@415Vac
Nominal Output Voltage (V)	400, 3L/N/PE or 3L/PE			500, 3L/PE
Nominal Output Frequency (Hz)	50/60	50/60	50/60	50/60
Max. Output Current (A)	96	96	96	89
Output Power Factor	~1 (Adjustable from 0.8 leading to 0.8 lagging)			
Output THDi (@Nominal Output)	<3%	<3%	<3%	<3%

For example, a 60kW inverter with 10% overloading capacity, will have a 66kw output under 400V voltage. Under 415V voltage, however, AC output can reach 69 kW and AC overloading capacity therefore exceeds 10%. The formula is AC maximum power =Max. output current\* Nominal output voltage\*√3

For example for a 60kw inverter when grid voltage is 380V  
 AC Maximum power= 380\*96\*1.732= 63.18kw.  
 That means under 380V, the AC overloading capacity is less than 10%.

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